

## BAB II

### PERENCANAAN PELAT DAK

#### 2.1 Pembebanan Pelat

Mutu baja :  $f_y := 240 \text{ Mpa}$

Mutu beton :  $f_c := 18.675 \text{ Mpa}$

Tebal pelat yang direncanakan :

- Tebal pelat lantai  $T_p := 100 \text{ mm}$

Beban - beban untuk bangunan rumah berdasarkan Peraturan Pembebanan Indonesia untuk Gedung 1983 ( PPIUG 1983 ) :

##### 1. Beban Mati ( DL ) :

- Berat sendiri pelat  $W_{plt} := 0.10 \cdot 2400 = 240 \text{ kg/m}^2$
- Berat finishing ( 2 cm )  $W_f := 2 \cdot 21 = 42 \text{ kg/m}^2$
- Berat ducting & Plumbing  $W_{dp} := 40 \text{ kg/m}^2$
- Berat keramik  $W_k := 0.24 = 0 \text{ kg/m}^2$
- Berat plafond & penggantung  $W_{pl} := 18 \text{ kg/m}^2$

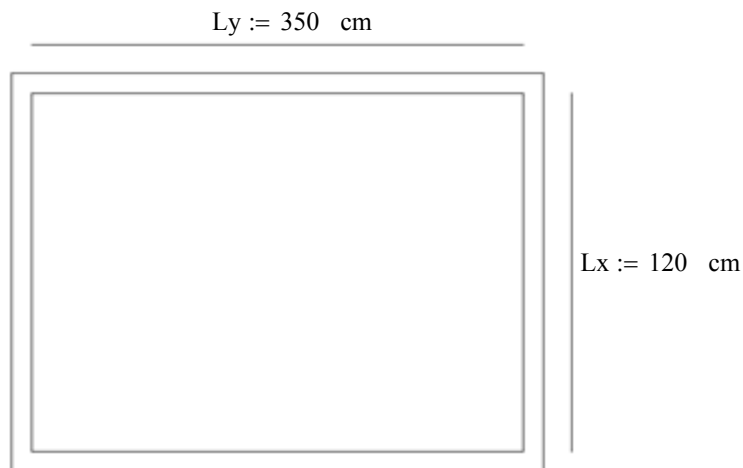
$$DL := W_{plt} + W_{dp} + W_f + W_k + W_{pl} = 340 \text{ kg/m}^2$$

##### 2. Beban Hidup ( LL ) : ( PPIUG 1983 tabel 3.1 )

$$LL := 100 \text{ kg/m}^2$$

kombinasi pembebanan (  $q_u$  )

$$q_u := 1.2DL + 1.6 \cdot LL = 568 \text{ kg/m}^2$$



$$L_{yn} := 350 - \left( \frac{15 + 15}{2} \right) = 335 \text{ cm}$$

$$L_{xn} := 120 - \left( \frac{15 + 15}{2} \right) = 105 \text{ cm}$$

$$\beta_1 := \frac{L_{yn}}{L_{xn}} = 3.19 > 2 \rightarrow \text{( pelat satu arah )}$$

Harga  $\beta$  tergantung dari mutu beton, yaitu menurut SNI 2847 pasal 3.3.2 butir 7 atau PBI 1971 10.2.7.3, maka untuk  $30 \leq f'_c \leq 55$  Mpa

$$\text{untuk } f'_c = 18.675 \text{ Mpa} \rightarrow \beta := 0.85$$

Adapun data - data perencanaan untuk penulangan lantai

- Tebal pelat :  $T_p := 100 \text{ mm}$
- Tebal decking  $s := 20 \text{ mm}$
- Diameter tulangan rencana  $\phi := 8 \text{ mm}$
- Mutu tulangan baja  $f_y = 240 \text{ Mpa}$
- Mutu beton  $f'_c = 18.675 \text{ Mpa}$

$$d_x := 100 - 20 - (0.5 \cdot 6) = 77 \text{ mm}$$

$$d_y := 100 - 20 - 6 - (0.5 \cdot 6) = 71 \text{ mm}$$

$$\beta = 0.85$$

$$b_l := 1000 \text{ mm}$$

$$q_u = 568 \text{ kg/m}^2$$

Berdasarkan SNI 2847 pasal 10.4.3 :

$$\rho_{\text{balance}} := \frac{0.85 \cdot \beta \cdot f'_c \cdot \left( \frac{600}{600 + f_y} \right)}{f_y} = 0.0402$$

$$\rho_{\text{max}} := 0.75 \cdot \rho_{\text{balance}} = 0.0301$$

Berdasarkan SNI 03-2847-2002 pasal 9.12.2.1

$$\rho_{\text{min}} := 0.0018 \text{ (keperluan minimum untuk tulangan susut pelat)}$$

$$m := \frac{f_y}{0.85 \cdot f'_c} = 15.12$$

Dengan menggunakan koefisien momen PBI 1971 tabel 13.3.2 didapat persamaan momen

$$\text{sebagai berikut : } \frac{L_{yn}}{L_{xn}} = 3.19$$

$$M_{lx} \rightarrow \text{nilai } x_1 := 63$$

$$M_{tx} \rightarrow \text{nilai } x_2 := 63$$

$$M_{ly} \rightarrow \text{nilai } x_3 := 38$$

$$M_{ty} \rightarrow \text{nilai } x_4 := 38$$

$$M_{lx} := 0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_1 = 394518.6 \text{ Nmm}$$

$$M_{tx} := -0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_2 = -394518.6 \text{ Nmm}$$

$$M_{ly} := 0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_3 = 237963.6 \text{ Nmm}$$

$$M_{ty} := -0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_4 = -237963.6 \text{ Nmm}$$

## 2.2 Perhitungan Penulangan

- **Perhitungan penulangan pelat arah x**

$$M_u := M_{lx} = 394518.6 \text{ Nmm}$$

$$M_n := \frac{M_u}{0.8} = 493148.25 \text{ Nmm}$$

$$R_n := \frac{M_n}{b \cdot d_x^2} = 0.0832 \frac{\text{N}}{\text{mm}^2}$$

$$\rho_{\text{perlu}} := \frac{1 \cdot \left( 1 - \sqrt{1 - 2 \frac{m \cdot R_n}{f_y}} \right)}{m} = 0.0003$$

$$\rho_{\text{perlu}} = 0.0003 < \rho_{\text{min}} = 0.0018$$

$$A_{\text{perlu}} := \rho_{\text{min}} \cdot b \cdot d_x = 138.6 \text{ mm}^2$$

**pakai tulangan  $\phi 8$  - 200**

$$A_s := 5 \cdot 0.785 \cdot 8^2 = 251.2 \text{ mm}^2 \quad \blacksquare > \blacksquare \quad A_{\text{perlu}} = 138.6 \text{ mm}^2$$

- **Perhitungan penulangan pelat arah y**

$$M_u := M_{ly} = 237963.6 \text{ Nmm}$$

$$M_n := \frac{M_u}{0.8} = 297454.5 \text{ Nmm}$$

$$R_n := \frac{M_n}{b \cdot d_y^2} = 0.059 \frac{\text{N}}{\text{mm}^2}$$

$$\rho_{\text{perlu}} := \frac{1 \cdot \left( 1 - \sqrt{1 - 2 \frac{m \cdot R_n}{f_y}} \right)}{m} = 0.0003$$

$$\rho_{\text{perlu}} = 0.0003 < \rho_{\text{min}} = 0.0018$$

$$A_{\text{perlu}} := \rho_{\text{min}} \cdot b \cdot d_y = 127.8 \text{ mm}^2$$

**pakai tulangan  $\phi 8$  - 200**

$$A_s := 5 \cdot 0.785 \cdot 8^2 = 251.2 \text{ mm}^2 \quad \blacksquare > \blacksquare \quad A_{\text{perlu}} = 127.8 \text{ mm}^2$$